(No Model.) 2 Sheets—Sheet 1.

W. KINGSLAND.

ELECTRICAL TRACTION.

No. 592,056. Patented Oct. 19, 1897.

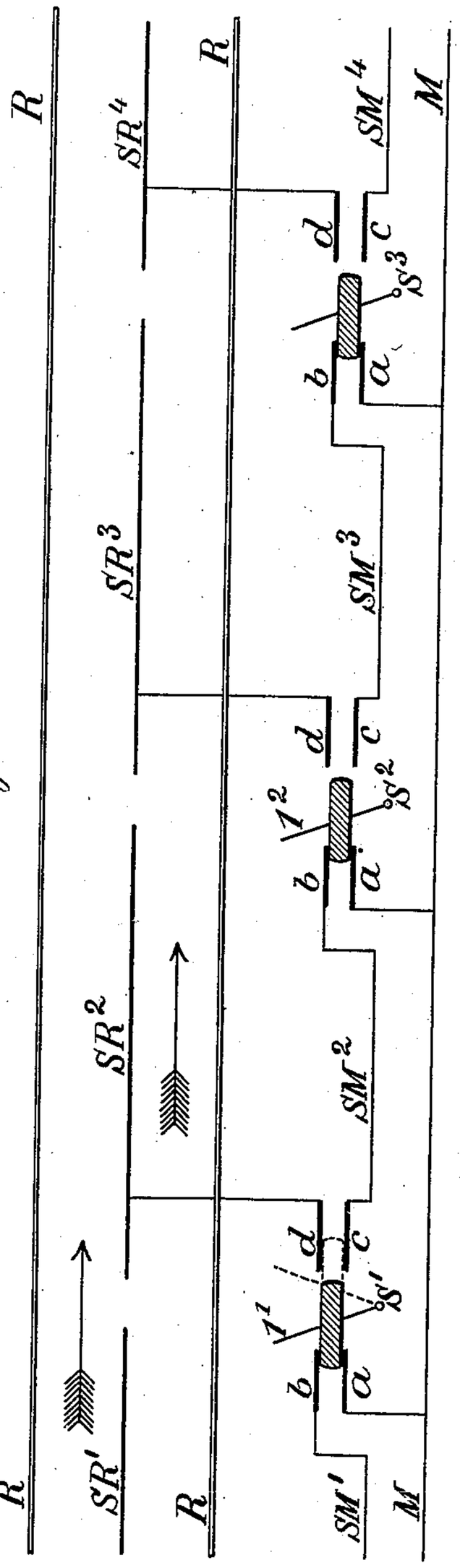

Fig. 1.

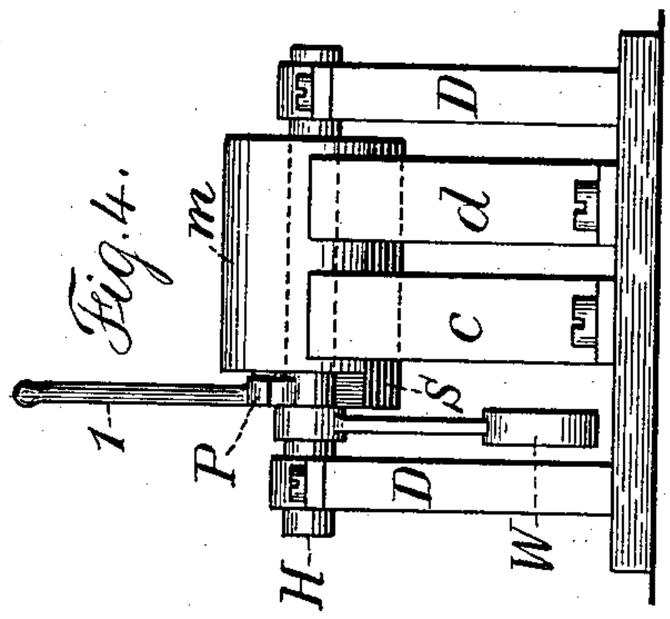

Fig. 4.

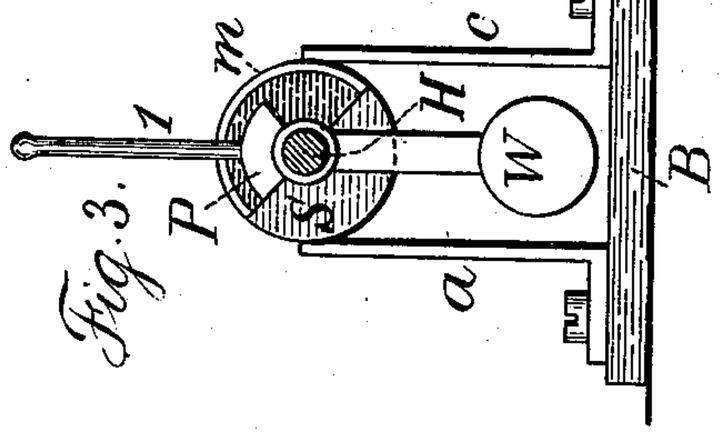

Fig. 3.

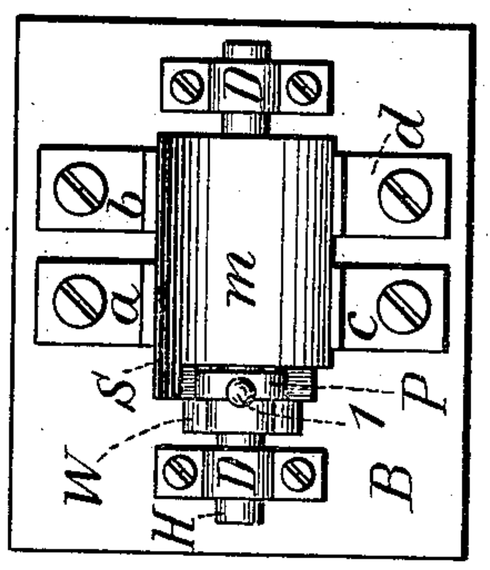

Fig. 2.

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(No Model.) 2 Sheets—Sheet 2.

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ELECTRICAL TRACTION.

No. 592,056. Patented Oct. 19, 1897.

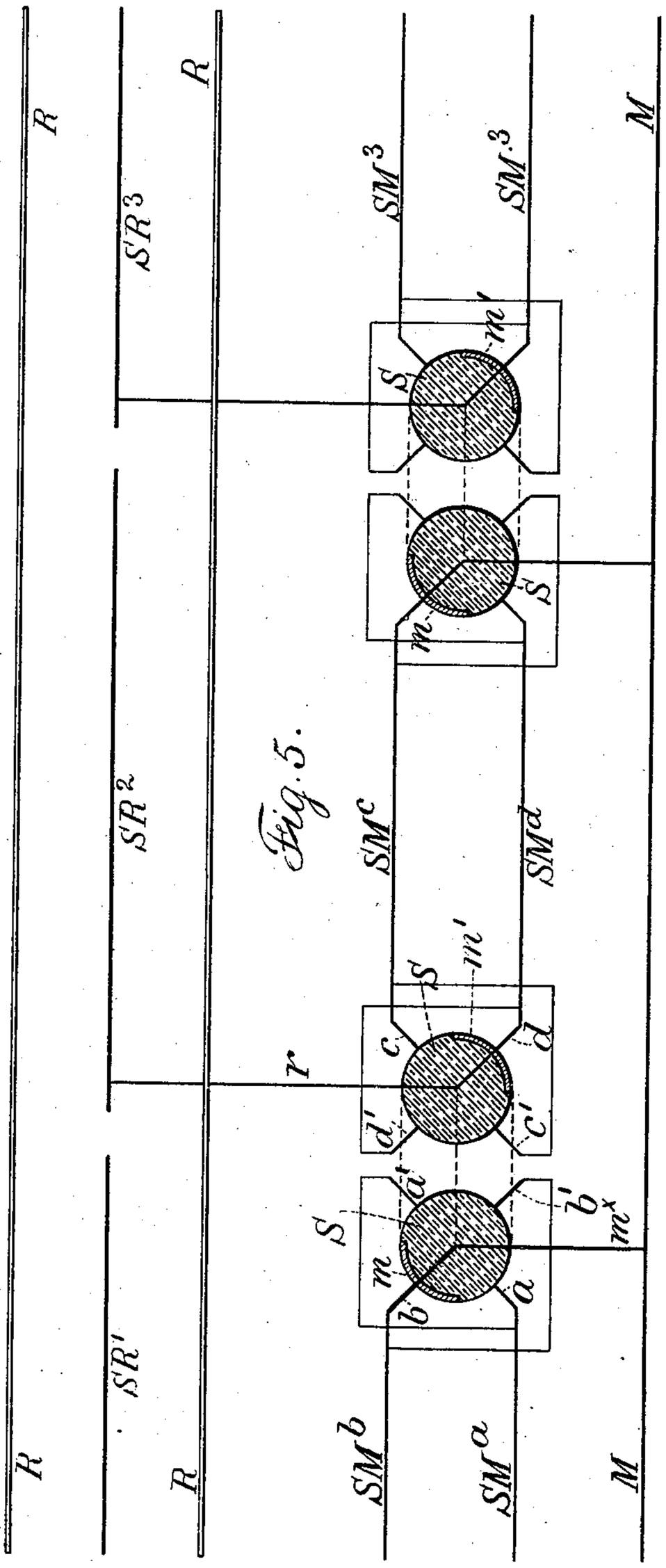

Fig. 5.

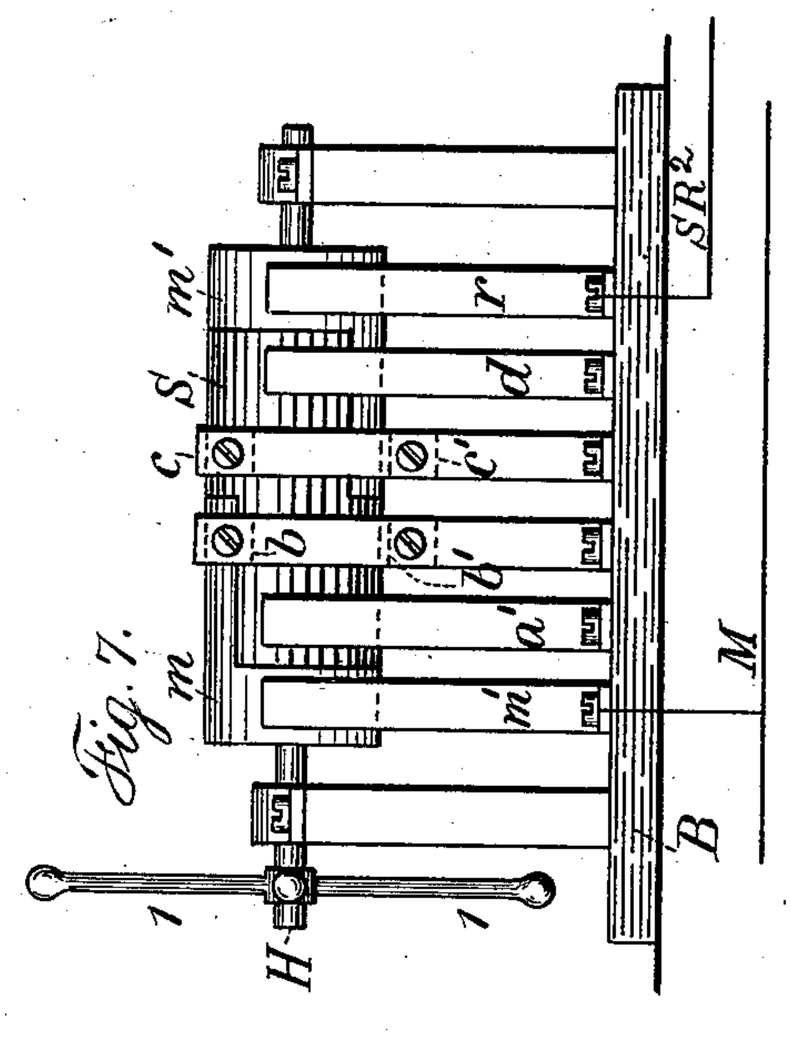

Fig. 7.

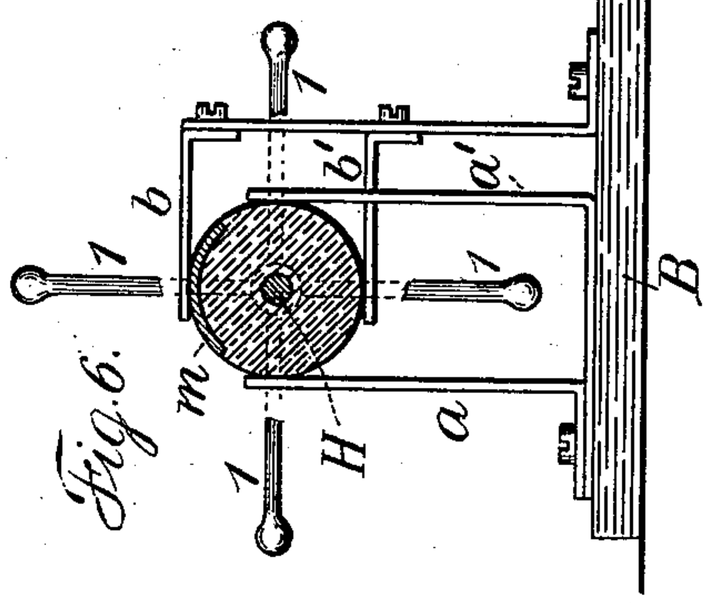

Fig. 6.

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UNITED STATES PATENT OFFICE.

WILLIAM KINGSLAND, OF LLANDUDNO, ENGLAND.

ELECTRICAL TRACTION.

SPECIFICATION forming part of Letters Patent No. 592,056, dated October 19, 1897.

Application filed March 5, 1897. Serial No. 626,063. (No model.) Patented in England May 21, 1896, No. 10,906.

To all whom it may concern:

Be it known that I, WILLIAM KINGSLAND, a subject of the Queen of Great Britain, residing at Llandudno, in the county of Carnarvon, England, have invented certain new and useful Improvements in or Connected with Electrical Traction, (for which I have obtained a patent in Great Britain, No. 10,906, bearing date May 21, 1896,) of which the following is a specification.

In electrical traction the electrical current has been conveyed from a main conductor to the moving vehicle through "sectional" working conductors, these latter being of greater or less length, and from which sections the current is conveyed to the motor on the vehicle and an electrical contact is made with the successive sections as the vehicle passes along the track. These sectional working conductors are successively connected with the main conductor from the supply-station and disconnected when the vehicle has passed on to another section, and various devices have been proposed for automatically and successively connecting and disconnecting the sections and the main conductor.

My invention refers to improvements in and connected with the connection and disconnection of the various sectional working conductors to or from the main conductor, all as hereinafter described.

With my invention in its simplest form, one or both of the rails upon which the vehicle travels generally serve to convey the return current of electricity to the generating-station, and they are usually uninsulated and consequently in connection with "earth," while the vehicle collects the current from the sectional working conductors by means of brushes or other frictional or contact appliances that are well known.

According to my invention I provide for every sectional working conductor a second sectional conductor, which I will call a "sectional auxiliary conductor," through which latter the current passes from the main to the said usual sectional working conductor, and my sectional auxiliary conductors are each provided with a commutator or switch at each end, whereby each auxiliary conductor may be either connected or disconnected from the main conductor or from the usual sectional working conductor. The commutators or switches are operated mechanically by the passing vehicle, all as hereinafter described. It is to be understood that these usual sectional working conductors may be in any convenient position relatively to the road-rails, or even that one or both of the road-rails may themselves form sectional conductors, or the latter may be composed of any convenient form of conductor suitable for conveying a current to the moving vehicle.

My invention is also applicable generally to what is known as the "conduit system."

In the drawings, Figure 1 is a diagrammatic plan view illustrating one general arrangement or application of my invention. Fig. 2 is a plan view; Fig. 3, an end view. Fig. 4 is a side elevation of apparatus for changing the contacts, especially applicable where vehicles run alternately in opposite directions. Fig. 5 is a diagrammatic plan view of a double commutator arrangement by which vehicles traveling in either direction effect the proper connections. Fig. 6 is an end view of the commutator and operating-levers, and Fig. 7 is a side view of same.

In diagram, Fig. 1, M is the main conductor conveying the current from the generating-station, and it is insulated by any of the well-known methods.

SR' SR^2 SR^3 SR^4 indicate the usual sectional working conductors from which the moving vehicle collects the current by means of suitable frictional appliances or contacts. For each sectional working conductor, but not normally in electrical contact therewith, I provide according to my invention an insulated sectional auxiliary conductor, and these sectional auxiliary conductors SM' SM^2 SM^3 SM^4 serve to convey the current at times, as hereinafter explained, from the continuous main to the sectional working conductors, respectively.

Supposing my sectional auxiliary conductor to be located, as in Fig. 1, between the electrical main conductor M and the usual sectional working conductors SR' SR^2 SR^3 SR^4, I provide a contact-spring *b c* at each end of each sectional auxiliary conductor SM' SM^2, &c., and at a short distance from, say, the left-hand end of a sectional auxiliary conductor—that is, at a short distance from

the contact-spring *c* thereof—I arrange a contact piece or spring *d*, which is in electrical connection with a sectional working conductor, while the contact-piece *b* at the other end of the sectional auxiliary conductor is adjacent to a contact piece or spring *a* in electrical connection with the electrical main conductor. The next adjacent sectional auxiliary conductor is exactly similarly arranged and fitted, while movable contact-pieces, slides, switches, or commutators S' S^2 S^3 are arranged, which switches or commutators when in one position serve to connect one end of a sectional auxiliary conductor with a sectional working conductor—that is to say, to connect the contacts *c d*—and in another position connect the adjacent end of the next sectional auxiliary conductor with the main conductor—that is to say, connect the contacts *a* and *b*. Insulated levers $1'$ 1^2 1^3, &c., or other well-known mechanical contrivance, actuated by, say, a tappet-piece on the passing vehicle, serve to move the contact-pieces and connect one or other pairs of contacts.

It will now be seen that when the levers are all in one direction, as in Fig. 1, there will be no connection between the main conductor and any of the usual sectional working conductors. Suppose, however, that a vehicle is passing in the direction of the arrow from sectional working conductor SR' to sectional working conductor SR^2, it will by its tappet action turn the lever $1'$ and the switch S' into the position shown by the dotted lines, and will thereby complete the connections between the contacts *c* and *d* and put the sectional auxiliary conductor SM^2 into electrical contact with the sectional working conductor SR^2, at the same time disconnecting sectional auxiliary conducter SM' from the main conductor M at the contacts *a* and *b*. Sectional working conductor SR^2 will now be in electrical contact with the main conductor M, through the contact-pieces *a* and *b* of the switch S^2, the sectional auxiliary conductor SM^2, and the contacts *c* and *d* of the switch S'. When the vehicle reaches the end of the sectional conductor SR^2 and is about to enter upon SR^3 it will operate the lever 1^2 and the switch S^2, changing the contacts from *a b* to *c d*, and thereby cutting off sectional working conductor SR^2 from the main and connecting SR^3, and so on for all the sections in the line.

A convenient form of apparatus for changing the contacts in the manner just described is shown in plan at Fig. 2, in end view in one position at Fig. 3, and Fig. 4 is a side elevation. Referring to these figures, S is a cylinder, of vulcanized fiber or other suitable insulating material, carried loosely upon a spindle H. One half of the cylinder is covered by a plate of brass or other metal *m*, and the contact pieces or springs, already mentioned, *a b c d* when referring to Fig. 1 are arranged on an insulating-support B, two on each side of the cylinder and pressing against it. The operating-lever 1, which has also a counterweight W attached to it, is keyed or fixed on the spindle H and has a projecting piece P, which is made in the form of a quadrant. The upper half of the cylinder S is partly cut away at one end, Fig. 4, and the projecting piece P on the boss of the operating-lever engages with the uncut portion. By this arrangement if the lever 1 is pressed to one side it will turn the cylinder and cause a contact to be made between one pair of contact-springs, at the same time disconnecting the other pair. As soon as the pressure is removed from the lever it will return to an upright position by reason of its counterbalance W without moving the cylinder, as the cut portion of the latter allows of the lever 1 making a quarter-turn before it engages with the uncut portion. The lever 1 will then be ready to effect a reversal of the contacts when pressed in the opposite direction. The contacts may be arranged so that one pair is not disconnected until the other is actually connected, and thus sparking will be avoided, and to effect this object the plate *m* should be slightly more than the half-circumference of the cylinder. Such a switch or commutator apparatus may be inclosed in any suitable cast-iron or other box, which may also be made water and air tight, and in that case the spindle will pass out through a gland and the lever will be fastened to it on the outside of the box. The conductors should also pass in through suitable water and air tight glands. The contacts may be made of copper-wire gauze or other suitable material, and with this form of commutator a good and firm connection may be made for very large currents.

It will be understood with the arrangements as already described that a vehicle moving in one direction will leave all the switches also all in one direction, and consequently another vehicle cannot follow in the same direction, because the commutators will be so placed that they can only be operated by a vehicle passing in the opposite direction, and thus this arrangement is only applicable where the vehicles run alternately in opposite directions.

In order that the vehicles may travel in either direction with equal facility, I employ a pair of my sectional auxiliary conductors and a suitable form of double commutator.

In the diagrammatic plan view, Fig. 5, the double commutators S are shown, with the various connections.

In Fig. 5, R R indicate the rails upon which the vehicles run, SR' SR^2 SR^3 the usual sectional working conductors, and M the main conductor.

The commutator-switch S, Figs. 5, 6, and 7, consists of a cylinder of insulating material, of which the two ends are shown diagrammatically in Fig. 5.

m m' are two metal plates, parts of which cover slightly more than one-quarter of the

circumference of the insulating-cylinder and extend about half-way along the length of same in opposite directions, as shown in Fig. 7, while the same metal plates *m m'* near the ends of the cylinders extend entirely around the circumference of the cylinder.

SM[a] SM[b] are a pair of my sectional auxiliary conductors extending in one direction and terminating in contact-springs pressing against the commutator-cylinder S at *a* and *b*. These springs *a b* are cross-connected with a similar pair of springs *a' b'* at the opposite points of the commutator-switch.

SM[c] SM[d] are another pair of the sectional auxiliary conductors running in the opposite direction to SM[a] and SM[b]. These sectional auxiliary conductors also terminate in contact-springs at *c* and *d* and are cross-connected with similar contacts at *c' d'*.

The metal plate *m*, Fig. 7, is in permanent connection through $m^{\times}$ with the main conductor M, as shown diagrammatically in Fig. 5, and the metal plate *m'* is in permanent connection through *r* with an ordinary sectional working conductor SR[2].

It will be seen that if a quarter-turn is given to the commutator-switch the connection through $m^{\times}$ and M and through *r* and M', respectively, will be changed from one of a pair of the sectional auxiliary conductors to the other of the same pair, and this will happen in whatever direction the quarter-turn is given to the commutator.

The commutator is rigidly fixed on a spindle H, Fig. 7, and at one end of the spindle are also fixed four arms or levers 1, at right angles to each other. The passing vehicle strikes by a tappet device and moves whichever of the arms 1 is in its path, so as to communicate a quarter-turn to the commutator, at the same time bringing one of the other arms 1 into position ready to be operated by the next vehicle passing in either direction.

I claim as my invention—

1. In electrical traction, the combination with a continuous main electrical conductor, and sectional working conductors from which the motor-car directly collects the current, of a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary conductor the current is passed from the main to the sectional working conductor aforesaid, and means whereby each sectional auxiliary conductor can be either connected to or disconnected from the main conductor or from its corresponding sectional working conductor, as set forth.

2. In electrical traction, the combination with a continuous main electrical conductor, and a series of sectional working conductors from which the motor-car collects the current, of a number of sectional auxiliary conductors, one such for every sectional working conductor and through which auxiliary sectional conductor the current is passed to the corresponding sectional working conductor aforesaid, contact-pieces at each end of each sectional auxiliary conductor, a contact-piece in constant electrical connection with the main conductor and adjacent to a contact-piece at one end of each sectional auxiliary conductor, and a contact-piece in constant electrical connection with a section of the sectional working conductor, and adjacent to the contact-piece at the other end of the sectional auxiliary conductor, and mechanical means operated by the motor-car either for forming an electrical connection between the contact-piece at one end of a sectional auxiliary conductor with a sectional working conductor, or forming an electrical connection between the contact-piece at the adjacent end of the next sectional auxiliary conductor with the main, or vice versa, as set forth.

3. In electrical traction, the combination with a continuous main electrical conductor and sectional working conductors from which the motor-car collects the current, of a number of sectional auxiliary conductors, one such for every sectional working conductor, and through which auxiliary conductor the current is passed from the main to the sectional working conductor aforesaid, a cylindrical commutator or switch, a shaft to carry the cylinder, a balanced rock-lever on the shaft operated by the passing vehicle, a segment on the rock-lever, a projection on the cylinder against which the segment acts when rocked, to partially turn the cylinder, two contact-springs on one side of the cylinder respectively in connection with a sectional working conductor, and one end of an auxiliary sectional conductor, and two contact-springs on the other side of the cylinder respectively connected with the main conductor and with one end of the next adjacent auxiliary conductor, and a metallic plate on the cylinder adapted when in one position to electrically connect the two contact-springs on one side, and when rocked over to connect the two contact-springs on the other side, as set forth.

4. In electrical traction, the combination with a continuous main electrical conductor, and sectional working conductors from which the motor-car collects the current, of a series of pairs of sectional auxiliary conductors, one pair for every sectional working conductor, a cylindrical commutator between the ends of each pair of auxiliary sectional working conductors, arms connected with the commutator actuated by the passing vehicle, contact-springs coacting with metallic plates on the commutator and electrical connections to the contact-springs, so that when the commutator receives a partial turn in either direction, the connection between the main and the sectional conductors will be changed from one of a pair of sectional auxiliary conductors to the other of the same pair, as set forth.

5. The continuous main conductor having contacts at intervals along its line and the sectional working conductors for supplying current to the vehicle, and each having a ter-

minal contact, in combination with the auxiliary sectional conductors having contacts at both ends and switches receiving motion from the passing vehicle, the contacts being arranged in pairs at the switches so that one switch connects the sectional working conductor with the main conductor through the auxiliary sectional conductor and the next distant switch, and the second switch when moved breaks the circuit to the charged sectional working conductor and closes the circuit to the next sectional working conductor through the next auxiliary sectional conductor and the distant switch, substantially as specified.

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